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Sir:
Transmitted herewith for filing is the patent application of Inventor(s):
**Rick Allen Hamilton II and
Steven Jay Lipton**

For: **Data Processing System and Method for Distributing A Device Driver To A
Plurality of Client Computer Systems Each Executing Different Operating Systems**

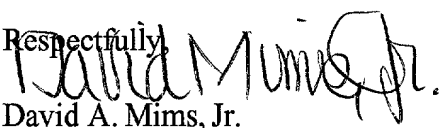
Enclosed are also:

- ☒ 22 Pages of Specification including an Abstract
- ☒ 10 Pages of Claims
- ☒ 7 Sheet(s) of Drawings (informal)
- ☒ A Declaration and Power of Attorney
- ☒ Form PTO 1595 and assignment of the invention to IBM Corporation

CLAIMS AS FILED

FOR	Number Filed		Number Extra		Rate		Basic Fee (\$710)
Total Claims	21	-20 =	1	X	\$ 18	=	\$18
Independent Claims	3	-3 =	0	X	\$ 80	=	\$0
Multiple Dependent Claims	0			X	\$270	=	\$
Total Filing Fee							= \$728

- ☒ Please charge \$728 to IBM Corporation, Deposit Account No. 50-0629.
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- ☒ Any additional filing fees required under 37CFR § 1.16.
- ☒ Any patent application processing fees under 37CFR § 1.17.

Respectfully,

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**DATA PROCESSING SYSTEM AND METHOD FOR DISTRIBUTING A
DEVICE DRIVER TO A PLURALITY OF CLIENT COMPUTER SYSTEMS
EACH EXECUTING DIFFERENT OPERATING SYSTEMS**

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BACKGROUND OF THE INVENTION

1. Technical Field:

The present invention relates to data processing
10 systems, and further to a data processing system
including a server computer system coupled to multiple
client computer systems for permitting the server to
distribute a device driver to the client computer systems
which are each executing a different operating system.
15 More particularly, the present invention relates to a
data processing system for distributing a device driver
to multiple client computer systems, each executing a
different operating system, by copying one of a plurality
of different executable versions of the device driver to
20 a client and causing the client to install the version on
the client.

2. Description of Related Art:

A major shift has occurred in recent years away from
25 traditional mainframe computer systems to a
client-server, distributed computer system model. Today,
organizations have hundreds or even thousands of
distributed servers installed throughout their
enterprises, each having more processing power than the
30 mainframe of just a few years ago.

Data storage, for the most part, is still directly
connected to a dedicated channel to the particular server
which it supports.

Problems occur, however, when such dedicated channels are maintained. When a computational resource needs data which is managed by one of its peers, it must query the peer with a request to provide this data. This results in a loss of effectiveness for the serving machine as it takes the time to honor the request. Also, directly attached disks lead to hardware inefficiencies, whereby one server may be out of disk space even as one of its peers has plenty of storage space to spare.

Unfortunately, in this model, the machine with the shortage has no way to directly access the extra space available on its peer's disks. Finally, it is difficult to scale capacity and performance to meet rapidly changing requirements, such as the explosive growth of e-business applications.

Recognizing the limitations of traditional storage architectures such as described above, systems architects have developed a new solution known as a Storage Area Network (SAN). The SAN provides a high-speed connection between servers which permits any resources coupled to it to access a common storage device pool. The SAN eliminates the traditional dedicated connection between a server and a storage device along with the concept that the server "owns and manages" the storage devices. The SAN introduces the flexibility of networking to enable one server or many heterogeneous servers to share a common storage utility which may comprise many storage devices. The SAN is unencumbered by geographical proximity, instead relying only upon persistent communications links. The SAN changes the server-centric model of the typical open systems information infrastructure, replacing it with a data-centric infrastructure.

One problem facing SAN implementation is present with other technologies as well. In such an environment it is time-consuming and can be difficult to effectively distribute SAN device drivers across a widespread, heterogeneous network. The device drivers may need to be installed upon Windows NT, AIX, Solaris, or other operating systems. Currently, in order to distribute the device drivers, an administrator must go to each target server, determine which operating system the target system is executing, select the device driver for that operating system, log-on to that system, and perform the device driver installation on that system before going to the next target system.

Thus, it would be beneficial to have an apparatus and method for distributing a device driver to multiple client computer systems where each client system is executing a different operating system.

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SUMMARY OF THE INVENTION

A data processing system and method are disclosed for automatically installing a device driver on a plurality of client computer systems which are each executing a different operating system. The data processing system includes a server computer system coupled to the client computer systems via a network. Each of the client computer systems executes a different operating system. Particular client computer systems are specified. These client computer systems are the systems which are to receive and install the device driver. Different versions of the device driver are created and stored within the server computer system. Each of the different versions of the device driver is executable by a different one of the operating systems. One of the different versions is copied to one of the client computer systems. This client computer system is executing one of the operating systems. The version of the device driver that is copied is the version which is executable by this operating system being executed by the client. The server computer system then causes the client computer system to install this version of the device driver on the client.

Other features and advantages of the present invention will be described in, or will become apparent to those of ordinary skill in the art in view of the following detailed description of the preferred embodiments of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

10 **Figure 1** is a pictorial representation of a distributed data processing system in which the present invention may be implemented;

15 **Figure 2** is a block diagram of a data processing system that may be implemented as a server computer system, such as server 104 shown in **Figure 1**, in accordance with the present invention;

20 **Figure 3** is a block diagram of a data processing system that may be implemented as a client computer system, such as one of the clients 108, 110, or 112 shown in **Figure 1**, in accordance with the present invention;

Figure 4A is a pictorial representation of a file which includes a listing of machines on which a device driver is to be installed in accordance with the present invention;

25 **Figure 4B** is a pictorial representation of a device driver and multiple, different versions of the device driver capable of being executed using multiple, different operating systems in accordance with the method and system of the present invention;

30 **Figure 5** is a high level flow chart which depicts the creation of a plurality of different versions of a device driver for different ones of a plurality of operating systems in accordance with the present

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invention;

5 **Figure 6** is a high level flow chart which depicts a creation of a file which includes a listing of machines selected to have a driver installed and the operating systems and network addresses of each machine in accordance with the present invention; and

10 **Figure 7** is a high level flow chart which illustrates a server computer system causing the installation of a device driver on multiple, different machines which are executing multiple, different operating systems in accordance with the present invention.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

5 A preferred embodiment of the present invention and its advantages are better understood by referring to Figures 1-7 of the drawings, like numerals being used for like and corresponding parts of the accompanying drawings.

10 The invention is preferably realized using a well-known computing platform, such as an IBM RS/6000 workstation running the IBM AIX operating system. However, it may be realized in other popular computer system platforms, such as an IBM personal computer
15 running the OS/2 operating system or a Sun Microsystems workstation running alternate operating systems such as Microsoft Windows, HP-UX, UNIX or LINUX, without departing from the spirit and scope of the invention.

20 The present invention is a method and system for automatically installing a device driver on a plurality of heterogeneous client computer systems. A data processing system includes a server computer system coupled to client computer systems via a network. Each of the client computer systems executes a different
25 operating system.

 First, one or more device drivers are specified. Various different operating systems are also specified. A first device driver is then selected. Different versions of the device driver are then created and stored
30 in the server computer system. Each version of the device driver is executable by a different one of the operating systems. In this manner, several different versions of the device driver are created and stored, one

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for each operating system.

A file is also created within the server computer system. Each client computer system selected to receive and install the device driver is listed within the file.

5 The file includes multiple entries, one for each client computer system on which to install the device driver. Each entry also identifies the operating system being executed by the client computer system associated with the entry, as well as the network address of the client
10 computer system.

When the device driver is to be automatically installed on the multiple, different heterogeneous client computer systems which are executing different operating systems, the server computer system retrieves the file.

15 The first entry in the file is retrieved. The operating system being executed by the client computer system associated with the first entry is determined.

The server computer system then copies the version of the driver which is executable by this operating
20 system to the client computer system identified by the first entry. The server computer system then causes this client computer system to install the version of the device driver the client received from the server.

With reference now to the figures, **Figure 1** depicts a
25 pictorial representation of a network of data processing systems in which the present invention may be implemented. Network data processing system **100** is a network of computers in which the present invention may be implemented. Network data processing system **100** contains
30 a network **102**, which is the medium used to provide communications links between various devices and computers connected together within network data processing system **100**. Network **102** may include connections, such as wire,

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wireless communication links, or fiber optic cables.

In the depicted example, a server 104 is connected to network 102 along with storage units 106, 114, and 116.

Alternatively, storage 106 may be coupled directly to server 104 with storage unit 114 coupled to client 108, for example, with storage unit 116 coupled to client 110.

A storage unit may, alternatively, be directly connected to server 104 with network 102 connected to clients 108, 110 and 112 in a Network File System (NFS) configuration.

Finally, server 104 and clients 108, 110, and 112 could all be directly connected to the same storage units 106, 114, and 116 in a Storage Area Network (SAN) configuration.

In addition, clients 108, 110, and 112 also are connected to network 102. These clients 108, 110, and 112 may be, for example, personal computers or network computers. In the depicted example, server 104 provides data, such as boot files, operating system images, and applications to clients 108-112. Clients 108, 110, and 112 are clients to server 104. Clients 108, 110, and 112 are preferably each executing a different operating system. Network data processing system 100 may include additional servers, clients, and other devices not shown.

In the depicted example, network data processing system 100 is the Internet with network 102 representing a worldwide collection of networks and gateways that use the TCP/IP suite of protocols to communicate with one another. At the heart of the Internet is a backbone of high-speed data communication lines between major nodes or host computers, consisting of thousands of commercial, government, educational and other computer systems that route data and messages. Of course, network data

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processing system 100 also may be implemented as a number of different types of networks, such as for example, an intranet, a local area network (LAN), or a wide area network (WAN). Figure 1 is intended as an example, and not as an architectural limitation for the present invention.

Referring to Figure 2, a block diagram of a data processing system that may be implemented as a server, such as server 104 in Figure 1, is depicted in accordance with a preferred embodiment of the present invention.

Data processing system 200 may be a symmetric multiprocessor (SMP) system including a plurality of processors 202 and 204 connected to system bus 206. Alternatively, a single processor system may be employed. Also connected to system bus 206 is memory controller/cache 208, which provides an interface to local memory 209. I/O bus bridge 210 is connected to system bus 206 and provides an interface to I/O bus 212. Memory controller/cache 208 and I/O bus bridge 210 may be integrated as depicted.

Peripheral component interconnect (PCI) bus bridge 214 connected to I/O bus 212 provides an interface to PCI local bus 216. A number of modems may be connected to PCI bus 216. Typical PCI bus implementations will support four PCI expansion slots or add-in connectors.

Communications links to network computers 108-112 in Figure 1 may be provided through modem 218 and network adapter 220 connected to PCI local bus 216 through add-in boards.

Additional PCI bus bridges 222 and 224 provide interfaces for additional PCI buses 226 and 228, from which additional modems or network adapters may be supported. In this manner, data processing system 200

allows connections to multiple network computers. A memory-mapped graphics adapter 230 and hard disk 232 may also be connected to I/O bus 212 as depicted, either directly or indirectly.

5 Those of ordinary skill in the art will appreciate that the hardware depicted in **Figure 2** may vary. For example, other peripheral devices, such as optical disk drives and the like, also may be used in addition to or in place of the hardware depicted. The depicted example is
10 not meant to imply architectural limitations with respect to the present invention.

The data processing system depicted in **Figure 2** may be, for example, an IBM RISC/System 6000 system, a product of International Business Machines Corporation in Armonk,
15 New York, running the Advanced Interactive Executive (AIX) operating system.

With reference now to **Figure 3**, a block diagram illustrating a data processing system is depicted in which the present invention may be implemented. Data processing
20 system 300 is an example of a client computer. Data processing system 300 employs a peripheral component interconnect (PCI) local bus architecture. Although the depicted example employs a PCI bus, other bus architectures such as Accelerated Graphics Port (AGP) and
25 Industry Standard Architecture (ISA) may be used. Processor 302 and main memory 304 are connected to PCI local bus 306 through PCI bridge 308. PCI bridge 308 also may include an integrated memory controller and cache memory for processor 302. Additional connections to PCI
30 local bus 306 may be made through direct component interconnection or through add-in boards. In the depicted example, local area network (LAN) adapter 310, SCSI host

bus adapter 312, and expansion bus interface 314 are connected to PCI local bus 306 by direct component connection. In contrast, audio adapter 316, graphics adapter 318, and audio/video adapter 319 are connected to
5 PCI local bus 306 by add-in boards inserted into expansion slots. Expansion bus interface 314 provides a connection for a keyboard and mouse adapter 320, modem 322, and additional memory 324. Small computer system interface (SCSI) host bus adapter 312 provides a connection for hard
10 disk drive 326, tape drive 328, and CD-ROM drive 330. Typical PCI local bus implementations will support three or four PCI expansion slots or add-in connectors.

An operating system runs on processor 302 and is used to coordinate and provide control of various components
15 within data processing system 300 in Figure 3. Preferably, each client will be executing a different operating system. The operating system may be a commercially available operating system, such as Windows 2000, which is available from Microsoft Corporation. An
20 object oriented programming system such as Java may run in conjunction with the operating system and provide calls to the operating system from Java programs or applications executing on data processing system 300. "Java" is a trademark of Sun Microsystems, Inc. Instructions for the
25 operating system, the object-oriented operating system, and applications or programs are located on storage devices, such as hard disk drive 326, and may be loaded into main memory 304 for execution by processor 302.

Those of ordinary skill in the art will appreciate
30 that the hardware in Figure 3 may vary depending on the implementation. Other internal hardware or peripheral devices, such as flash ROM (or equivalent nonvolatile

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memory) or optical disk drives and the like, may be used in addition to or in place of the hardware depicted in **Figure 3**. Also, the processes of the present invention may be applied to a multiprocessor data processing system.

As another example, data processing system **300** may be a stand-alone system configured to be bootable without relying on some type of network communication interface, whether or not data processing system **300** comprises some type of network communication interface. As a further example, data processing system **300** may be a Personal Digital Assistant (PDA) device, which is configured with ROM and/or flash ROM in order to provide non-volatile memory for storing operating system files and/or user-generated data.

The depicted example in **Figure 3** and above-described examples are not meant to imply architectural limitations. For example, data processing system **300** also may be a notebook computer or hand held computer in addition to taking the form of a PDA. Data processing system **300** also may be a kiosk or a Web appliance.

Figure 4A is a pictorial representation of a file **400** which includes a listing of client computer systems on which a device driver is to be installed in accordance with the present invention. File **400** includes a plurality of records, or entries. Each record, or entry includes an identity of a client, or "machine", the operating system being executed by that client, and the network address for the client. File **400** can be utilized to automatically install one or more device drivers on remote machines. File **400** is not associated with any one particular device driver. File **400** includes a plurality

of entries, such as entries 402, 404, and 406. Entry 402 indicates that a remote machine, "machine A", is executing the LINUX operating system. Further, machine A is located at a network address "986986". Entry 404
5 indicates that a remote machine, "machine B", is executing the OS/2 operating system and is located at a network address "924385". And, entry 406 indicates that a remote machine, "machine C", is executing the AIX operating system and is located at a network address
10 "286458".

When the present invention is executed, file 400 is used to automatically install a selected device driver on machines A, B, and C. File 400 may be utilized to install multiple, different device drivers.

15 **Figure 4B** is a pictorial representation of a device driver and multiple, different versions of the device driver capable of being executed using multiple, different operating systems in accordance with the method and system of the present invention. A device driver A
20 412 is stored in a storage device 410. Storage device 410 may be implemented utilizing any suitable storage device, such as storage 106.

Different versions of device driver A 412 have been created and stored in storage device 410. A version of
25 device driver A 412 has been created to be executed by LINUX, a version to be executed by OS/2, and a version to be executed by AIX. For example, driver version 414 has been created which is executable by LINUX. Driver version 416 has been created which is executable by OS/2.
30 And, driver version 418 has been created which is executable by AIX.

When a computer system executes the present

invention, a device driver is selected, such as device driver A 412. Versions of device driver A 412 are then created for selected operating systems. These versions are then saved for later use.

5 A file can then be created which includes each remote machine which is to have the selected driver installed. The file includes a plurality of entries. Each entry identifies each selected machine, the operating system being executed by the machine, and the
10 network address of the machine.

Then, when the present invention is executed, the file is used. Each entry in the file is retrieved by the server. First, the operating system being executed by the machine identified in the first entry is determined
15 by the server. The server then retrieves the driver version created for this operating system and copies it to the machine at the network address identified in the entry. The server then causes the remote machine to execute an INSTALL command in order to install the copy
20 of the version copied to the remote machine on the remote machine.

For example, when file 400 is used, entry 402 is first retrieved. A determination is made that "machine A" is executing LINUX. Therefore, driver version 414 is
25 retrieved and copied to the machine at network address "986986". Machine A at network address "986986" is then caused to execute an INSTALL command to install the copy of driver version 414 on machine A.

File 400 may be utilized to install multiple,
30 different device drivers. After a first device driver is distributed to and installed on the selected machines, another device driver may be selected where this second device driver also has multiple versions created and

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stored which are executable by different operating systems. File 400 is then used as described above to distribute the second device driver to the machines identified by file 400.

5 **Figure 5** is a high level flow chart which depicts the creation of a plurality of different versions of a device driver for different ones of a plurality of operating systems in accordance with the present invention. The process starts as depicted by block 500
10 and thereafter passes to block 502 which illustrates selecting a device driver to install on remote computer systems. These remote computer systems are also referred to as remote "machines". The remote machines will typically be executing different operating systems. Some
15 of the remote machines may be executing LINUX, others may be executing AIX, still others may be executing OS/2, and others may be executing yet a different operating system. The process then passes to block 504 which depicts specifying an operating system. Next, block 506
20 illustrates creating and storing an executable version of this selected driver which is capable of being executed by the specified operating system. Therefore, for example, if AIX was specified, an executable file is created which is a version of the driver which can be
25 executed by AIX. Thereafter, block 508 depicts a determination of whether or not another version of the driver is to be created. If a determination is made that another version is to be created, the process passes back to block 504 in order to select another, different
30 operating system. Referring again to block 508, if a determination is made that no other versions of this driver are to be created, the process passes to block 510 which illustrates a determination of whether or not

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another driver is to be selected in order to create and store different executable versions for that driver. If a determination is made that another driver is to be selected, the process passes back to block 502 in order to repeat this process for another driver. Different versions can then be created for this driver which can be executed by selected operating systems. Referring again to block 510, if a determination is made that no other drivers are to be selected, the process terminates as illustrated by block 512.

Figure 6 is a high level flow chart which depicts a creation of a file which includes a listing of machines selected to have a driver installed and the operating systems and network addresses of each machine in accordance with the present invention. The process starts as depicted by block 600 and thereafter passes to block 602 which illustrates selecting a driver. Next, block 604 depicts selecting remote machines on which to install a device driver. Thereafter, block 606 illustrates the computer system which is executing this process gathering a network address of each selected remote machine on which the driver is to be installed. The process then passes to block 608 which depicts the computer system which is executing this process determining which operating system is being executed by each selected remote machine. Then, block 610 illustrates the computer system creating a file, such as file 400. This file a listing of each selected remote machine, and the operating system and network address for each remote machine. The process then terminates as depicted by block 612.

Figure 7 is a high level flow chart which

illustrates a server computer system causing the installation of a device driver on multiple, different machines which are executing multiple, different operating systems in accordance with the present invention. The process starts as depicted by block 700 and thereafter passes to block 702 which illustrates the server getting a first entry from the file for a first remote machine on which the driver is to be installed. The first entry identifies a particular remote machine, the operating system being executed by the machine, and the network address of the machine. Next, block 704 depicts the server determining the operating system indicated in the entry. The process then passes to block 706 which illustrates the server determining a directory location within the machine within which to install the device driver. Any other commands required by the particular machine and its operating system are also determined.

Thereafter, block 708 depicts the server creating an install directory on the remote machine. Next, block 710 illustrates the server selecting a version of the device driver which is executable by the operating system determined as depicted by block 704. Block 712, then, illustrates the server computer system executing a remote COPY command to copy the selected version of the device driver to the directory created on the remote machine. Next, block 714 depicts the server computer system causing the remote machine to execute an INSTALL command. The INSTALL command will then cause the selected version to be installed on the remote machine. Thereafter, block 716 illustrates the server computer system reading the return code issued by the INSTALL command. Block 718, then, depicts the server determining whether or not the

return code indicates that the installation completed correctly. If a determination is made that the return code indicates that the installation did not complete correctly, the process passes to block 720 which

5 illustrates the server receiving an alert and logging the installation error. The process then passes to block 722. Referring again to block 718, if a determination is made that the return code indicates that the installation did complete correctly, the process passes to block 722.

10 Block 722 depicts a determination of whether or not this is the last entry in the file list. If a determination is made that this is the last entry, the process terminates as depicted by block 724. Referring again to block 722, if a determination is made that this
15 is not the last entry in the file, the process passes to block 726 which illustrates the server getting the next machine entry from the file. The process then passes back to block 704 in order to install a version of the driver on another remote machine.

20 The present invention provides a method and system for distributing a device driver automatically to a plurality of different types of client computer systems. A file is created which is a listing of each client computer system which is to receive the device driver.
25 The listing includes a plurality of records. Each record includes an identity of a particular remote client computer system, the operating system being executed by the particular computer system, and the network address of the particular computer system. In addition, an
30 executable version of the device driver is created and stored for each one of a plurality of different operating systems.

When a device driver is to be distributed, the file

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is queried to obtain the identity of the first remote computer system, its operating system, and its network address. The version of the driver which is executable by this operating system is then obtained and copied to
5 the computer system at the network address obtained from the record. The remote computer system is then caused to install the file. After this process is complete, the next record of the file is obtained, and the appropriate executable file is copied to and installed on the remote
10 computer system.

In this manner, a device driver may be easily installed on many different computer systems which are each executing different operating systems.

It is important to note that while the present
15 invention has been described in the context of a fully functioning data processing system, those of ordinary skill in the art will appreciate that the processes of the present invention are capable of being distributed in the form of a computer readable medium of instructions
20 and a variety of forms and that the present invention applies equally regardless of the particular type of signal bearing media actually used to carry out the distribution. Examples of computer readable media include recordable-type media such a floppy disc, a hard
25 disk drive, a RAM, CD-ROMs, and transmission-type media such as digital and analog communications links.

The description of the present invention has been presented for purposes of illustration and description, and is not intended to be exhaustive or limited to the
30 invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art. The embodiment was chosen and described in order to best explain the principles of the invention,

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the practical application, and to enable others of ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular use contemplated.

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CLAIMS:

What is claimed is:

1. A method in a data processing system including a
5 server computer system coupled to a plurality of
heterogeneous client computer systems via a network for
automatically installing a device driver on said
plurality of heterogeneous client computer systems,
wherein each of said heterogeneous client computer
10 systems executes a different one of a plurality of
operating systems, said method comprising the steps of:
specifying said plurality of heterogeneous client
computer systems to receive said device driver;
storing a plurality of different versions of said
15 device driver in said server computer system, wherein
each one of said plurality of different versions is
executable by only a different one of said plurality of
operating systems;
copying one of said plurality of different versions
20 of said device driver to one of said plurality of client
computer systems which is executing one of said plurality
of different operating systems, wherein said one of said
plurality of different versions of said device driver is
executable by said one of said plurality of different
25 operating systems; and
said server computer system causing said one of said
plurality of client computer systems to install said one
of said plurality of different versions of said device
driver.
30
2. The method according to claim 1, further comprising
the step of creating a file including a plurality of
entries, each one of said plurality of entries specifying

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a different one of said plurality of client computer systems, one of said plurality of different operating systems, and a network address of said one of said plurality of client computer systems.

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3. The method according to claim 2, further comprising the step of distributing said plurality of versions of said device driver to said plurality of client computer systems utilizing said file.

10

4. The method according to claim 3, wherein the step of distributing said plurality of versions of said device driver further comprises the steps of:

getting a first entry from said file utilizing said server computer system;

determining a first one of said plurality of operating systems included in said first entry utilizing said server computer system;

determining a network address for a first one of said plurality of client computer systems included in said first entry utilizing said server computer system;

retrieving a first one of said plurality of different versions of said device driver utilizing said server computer system, wherein said first one of said plurality of different versions of said device driver is executable by said first one of said plurality of operating systems; and

copying said first one of said plurality of different versions of said device driver to said first one of said plurality of client computer systems at said network address utilizing said server computer system.

5. The method according to claim 4, further comprising

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the steps of:

said server computer system determining a directory location within said one of said plurality of client computer systems to which to copy said one of said

5 plurality of different versions; and

storing said one of said plurality of different versions of said device driver in said directory location within said one of said plurality of client computer systems.

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6. The method according to claim 5, further comprising the step of said server computer system causing said one of said plurality of client computer systems to execute an installation command to install said one of said

15 plurality of different versions of said device driver.

7. The method according to claim 6, further comprising the steps of:

getting a second entry from said file utilizing said

20 server computer system;

determining a second one of said plurality of operating systems included in said second entry utilizing said server computer system;

determining a network address for a second one of

25 said plurality of client computer systems included in said second entry utilizing said server computer system;

retrieving a second one of said plurality of different versions of said device driver utilizing said server computer system, wherein said second one of said

30 plurality of different versions of said device driver is executable by said second one of said plurality of operating systems; and

copying said second one of said plurality of

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different versions of said device driver to said second one of said plurality of client computer systems at said network address utilizing said server computer system.

- 5 8. A data processing system including a server computer system coupled to a plurality of heterogeneous client computer systems via a network for automatically installing a device driver on said plurality of heterogeneous client computer systems, wherein each of
- 10 said heterogeneous client computer systems executes a different one of a plurality of operating systems, comprising:

means for specifying said plurality of heterogeneous client computer systems to receive said device driver;

- 15 means for storing a plurality of different versions of said device driver in said server computer system, wherein each one of said plurality of different versions is executable by only a different one of said plurality of operating systems;

- 20 means for copying one of said plurality of different versions of said device driver to one of said plurality of client computer systems which is executing one of said plurality of different operating systems, wherein said one of said plurality of different versions of said
- 25 device driver is executable by said one of said plurality of different operating systems; and

- means for said server computer system causing said one of said plurality of client computer systems to install said one of said plurality of different versions
- 30 of said device driver.

9. The system according to claim 8, further comprising:
- means for creating a file including a plurality of

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entries, each one of said plurality of entries specifying a different one of said plurality of client computer systems, one of said plurality of different operating systems, and a network address of said one of said plurality of client computer systems.

10. The system according to claim 9, further comprising means for distributing said plurality of versions of said device driver to said plurality of client computer systems utilizing said file.

11. The system according to claim 10, wherein said means for distributing said plurality of versions of said device driver further comprises:

means for getting a first entry from said file utilizing said server computer system;

means for determining a first one of said plurality of operating systems included in said first entry utilizing said server computer system;

means for determining a network address for a first one of said plurality of client computer systems included in said first entry utilizing said server computer system;

means for retrieving a first one of said plurality of different versions of said device driver utilizing said server computer system, wherein said first one of said plurality of different versions of said device driver is executable by said first one of said plurality of operating systems; and

means for copying said first one of said plurality of different versions of said device driver to said first one of said plurality of client computer systems at said network address utilizing said server computer system.

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12. The system according to claim 11, further comprising:

means for said server computer system determining a
5 directory location within said one of said plurality of
client computer systems to which to copy said one of said
plurality of different versions; and

means for storing said one of said plurality of
different versions of said device driver in said
10 directory location within said one of said plurality of
client computer systems.

13. The system according to claim 12, further comprising
means for said server computer system causing said one of
15 said plurality of client computer systems to execute an
installation command to install said one of said
plurality of different versions of said device driver.

14. The system according to claim 13, further
20 comprising:

means for getting a second entry from said file
utilizing said server computer system;

means for determining a second one of said plurality
of operating systems included in said second entry
25 utilizing said server computer system;

means for determining a network address for a second
one of said plurality of client computer systems included
in said second entry utilizing said server computer
system;

30 means for retrieving a second one of said plurality
of different versions of said device driver utilizing
said server computer system, wherein said second one of
said plurality of different versions of said device

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driver is executable by said second one of said plurality of operating systems; and

means for copying said second one of said plurality of different versions of said device driver to said
5 second one of said plurality of client computer systems at said network address utilizing said server computer system.

15. A computer readable media including a server
10 computer system coupled to a plurality of heterogeneous client computer systems via a network for automatically installing a device driver on said plurality of heterogeneous client computer systems, wherein each of
15 said heterogeneous client computer systems executes a different one of a plurality of operating systems, said computer readable media comprising:

instruction means for specifying said plurality of heterogeneous client computer systems to receive said device driver;

20 instruction means for storing a plurality of different versions of said device driver in said server computer system, wherein each one of said plurality of different versions is executable by only a different one of said plurality of operating systems;

25 instruction means for copying one of said plurality of different versions of said device driver to one of said plurality of client computer systems which is executing one of said plurality of different operating systems, wherein said one of said plurality of different
30 versions of said device driver is executable by said one of said plurality of different operating systems; and

instruction means for said server computer system causing said one of said plurality of client computer

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16. The computer readable media according to claim 15,
5 further comprising:

17. The computer readable media according to claim 16,
further comprising instruction means for distributing
15 said plurality of versions of said device driver to said
plurality of client computer systems utilizing said file.

instruction means for getting a first entry from
said file utilizing said server computer system;

instruction means for determining a network address
for a first one of said plurality of client computer
systems included in said first entry utilizing said
30 server computer system;

instruction means for retrieving a first one of said plurality of different versions of said device driver utilizing said server computer system, wherein said first

Parameter	Value	Unit
Initial temperature	25.0	°C
Final temperature	25.0	°C
Initial pressure	1.0	atm
Final pressure	1.0	atm
Initial volume	1.0	L
Final volume	1.0	L
Initial mass	1.0	g
Final mass	1.0	g
Initial density	1.0	g/L
Final density	1.0	g/L
Initial concentration	1.0	mol/L
Final concentration	1.0	mol/L
Initial pH	7.0	
Final pH	7.0	
Initial ionic strength	1.0	M
Final ionic strength	1.0	M
Initial activity	1.0	
Final activity	1.0	
Initial fugacity	1.0	atm
Final fugacity	1.0	atm
Initial chemical potential	1.0	kJ/mol
Final chemical potential	1.0	kJ/mol
Initial Gibbs free energy	1.0	kJ/mol
Final Gibbs free energy	1.0	kJ/mol
Initial enthalpy	1.0	kJ/mol
Final enthalpy	1.0	kJ/mol
Initial entropy	1.0	kJ/mol·K
Final entropy	1.0	kJ/mol·K
Initial heat capacity	1.0	kJ/mol·K
Final heat capacity	1.0	kJ/mol·K
Initial viscosity	1.0	Pa·s
Final viscosity	1.0	Pa·s
Initial thermal conductivity	1.0	W/m·K
Final thermal conductivity	1.0	W/m·K
Initial diffusivity	1.0	m²/s
Final diffusivity	1.0	m²/s
Initial permeability	1.0	mol·m/s·m²·Pa
Final permeability	1.0	mol·m/s·m²·Pa
Initial sorption coefficient	1.0	mol/m³·Pa
Final sorption coefficient	1.0	mol/m³·Pa
Initial partition coefficient	1.0	
Final partition coefficient	1.0	
Initial distribution coefficient	1.0	
Final distribution coefficient	1.0	
Initial extraction coefficient	1.0	
Final extraction coefficient	1.0	
Initial separation factor	1.0	
Final separation factor	1.0	
Initial selectivity	1.0	
Final selectivity	1.0	
Initial rejection	1.0	
Final rejection	1.0	
Initial flux	1.0	mol/m²·s
Final flux	1.0	mol/m²·s
Initial permeation rate	1.0	mol/m²·s·Pa
Final permeation rate	1.0	mol/m²·s·Pa
Initial sorption rate	1.0	mol/m²·s·Pa
Final sorption rate	1.0	mol/m²·s·Pa
Initial desorption rate	1.0	mol/m²·s·Pa
Final desorption rate	1.0	mol/m²·s·Pa
Initial permeation time	1.0	s
Final permeation time	1.0	s
Initial sorption time	1.0	s
Final sorption time	1.0	s
Initial desorption time	1.0	s
Final desorption time	1.0	s
Initial permeation length	1.0	m
Final permeation length	1.0	m
Initial sorption length	1.0	m
Final sorption length	1.0	m
Initial desorption length	1.0	m
Final desorption length	1.0	m
Initial permeation area	1.0	m²
Final permeation area	1.0	m²
Initial sorption area	1.0	m²
Final sorption area	1.0	m²
Initial desorption area	1.0	m²
Final desorption area	1.0	m²
Initial permeation volume	1.0	m³
Final permeation volume	1.0	m³
Initial sorption volume	1.0	m³
Final sorption volume	1.0	m³
Initial desorption volume	1.0	m³
Final desorption volume	1.0	m³
Initial permeation mass	1.0	kg
Final permeation mass	1.0	kg
Initial sorption mass	1.0	kg
Final sorption mass	1.0	kg
Initial desorption mass	1.0	kg
Final desorption mass	1.0	kg
Initial permeation energy	1.0	J
Final permeation energy	1.0	J
Initial sorption energy	1.0	J
Final sorption energy	1.0	J
Initial desorption energy	1.0	J
Final desorption energy	1.0	J
Initial permeation power	1.0	W
Final permeation power	1.0	W
Initial sorption power	1.0	W
Final sorption power	1.0	W
Initial desorption power	1.0	W
Final desorption power	1.0	W
Initial permeation efficiency	1.0	%
Final permeation efficiency	1.0	%
Initial sorption efficiency	1.0	%
Final sorption efficiency	1.0	%
Initial desorption efficiency	1.0	%
Final desorption efficiency	1.0	%
Initial permeation selectivity	1.0	
Final permeation selectivity	1.0	
Initial sorption selectivity	1.0	
Final sorption selectivity	1.0	
Initial desorption selectivity	1.0	
Final desorption selectivity	1.0	
Initial permeation rejection	1.0	
Final permeation rejection	1.0	
Initial sorption rejection	1.0	
Final sorption rejection	1.0	
Initial desorption rejection	1.0	
Final desorption rejection	1.0	
Initial permeation flux	1.0	mol/m²·s
Final permeation flux	1.0	mol/m²·s
Initial sorption flux	1.0	mol/m²·s
Final sorption flux	1.0</	

one of said plurality of different versions of said device driver is executable by said first one of said plurality of operating systems; and

instruction means for copying said first one of said plurality of different versions of said device driver to said first one of said plurality of client computer systems at said network address utilizing said server computer system.

19. The computer readable media according to claim 18, further comprising:

instruction means for said server computer system determining a directory location within said one of said plurality of client computer systems to which to copy said one of said plurality of different versions; and

instruction means for storing said one of said plurality of different versions of said device driver in said directory location within said one of said plurality of client computer systems.

20. The computer readable media according to claim 19, further comprising instruction means for said server computer system causing said one of said plurality of client computer systems to execute an installation command to install said one of said plurality of different versions of said device driver.

21. The computer readable media according to claim 20, further comprising:

instruction means for getting a second entry from said file utilizing said server computer system;

instruction means for determining a second one of said plurality of operating systems included in said

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second entry utilizing said server computer system;

instruction means for determining a network address for a second one of said plurality of client computer systems included in said second entry utilizing said

5 server computer system;

instruction means for retrieving a second one of said plurality of different versions of said device driver utilizing said server computer system, wherein said second one of said plurality of different versions
10 of said device driver is executable by said second one of said plurality of operating systems; and

instruction means for copying said second one of said plurality of different versions of said device driver to said second one of said plurality of client
15 computer systems at said network address utilizing said server computer system.

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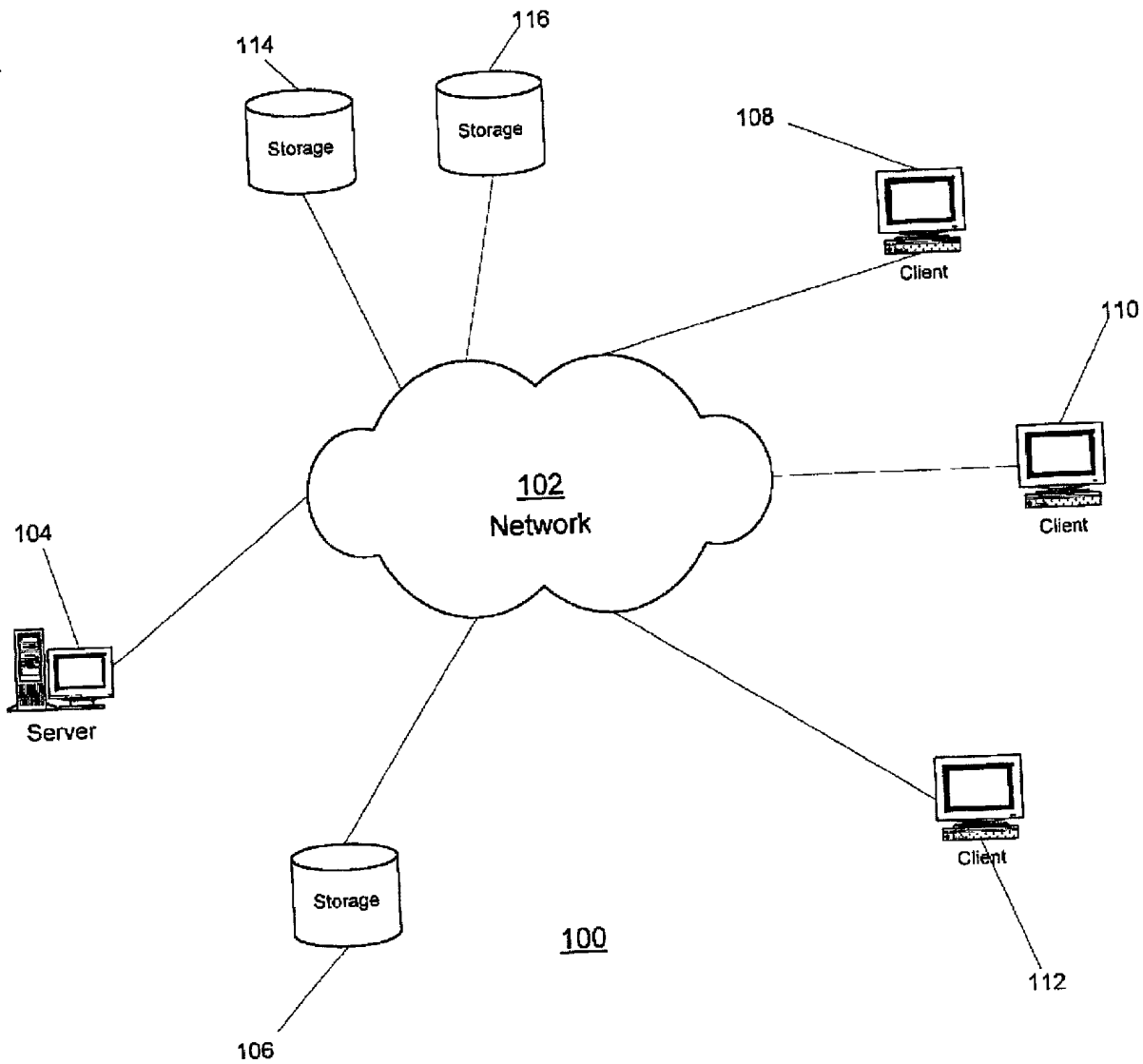
ABSTRACT OF THE DISCLOSURE

5 DATA PROCESSING SYSTEM AND METHOD FOR DISTRIBUTING A
DEVICE DRIVER TO A PLURALITY OF CLIENT COMPUTER SYSTEMS
EACH EXECUTING DIFFERENT OPERATING SYSTEMS

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10 A data processing system and method are disclosed
for automatically installing a device driver on a
plurality of client computer systems which are each
executing a different operating system. The data
processing system includes a server computer system
coupled to the client computer systems via a network.
Each of the client computer systems executes a different
15 operating system. Particular client computer systems are
specified. These client computer systems are the systems
which are to receive and install the device driver.
Different versions of the device driver are created and
stored within the server computer system. Each of the
20 different versions of the device driver is executable by
a different one of the operating systems. One of the
different versions is copied to one of the client
computer systems. This client computer system is
executing one of the operating systems. The version of
25 the device driver that is copied is the version which is
executable by this operating system being executed by the
client. The server computer system then causes the
client computer system to install this version of the
device driver on the client.

Figure 1
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Sheet 1 of 7



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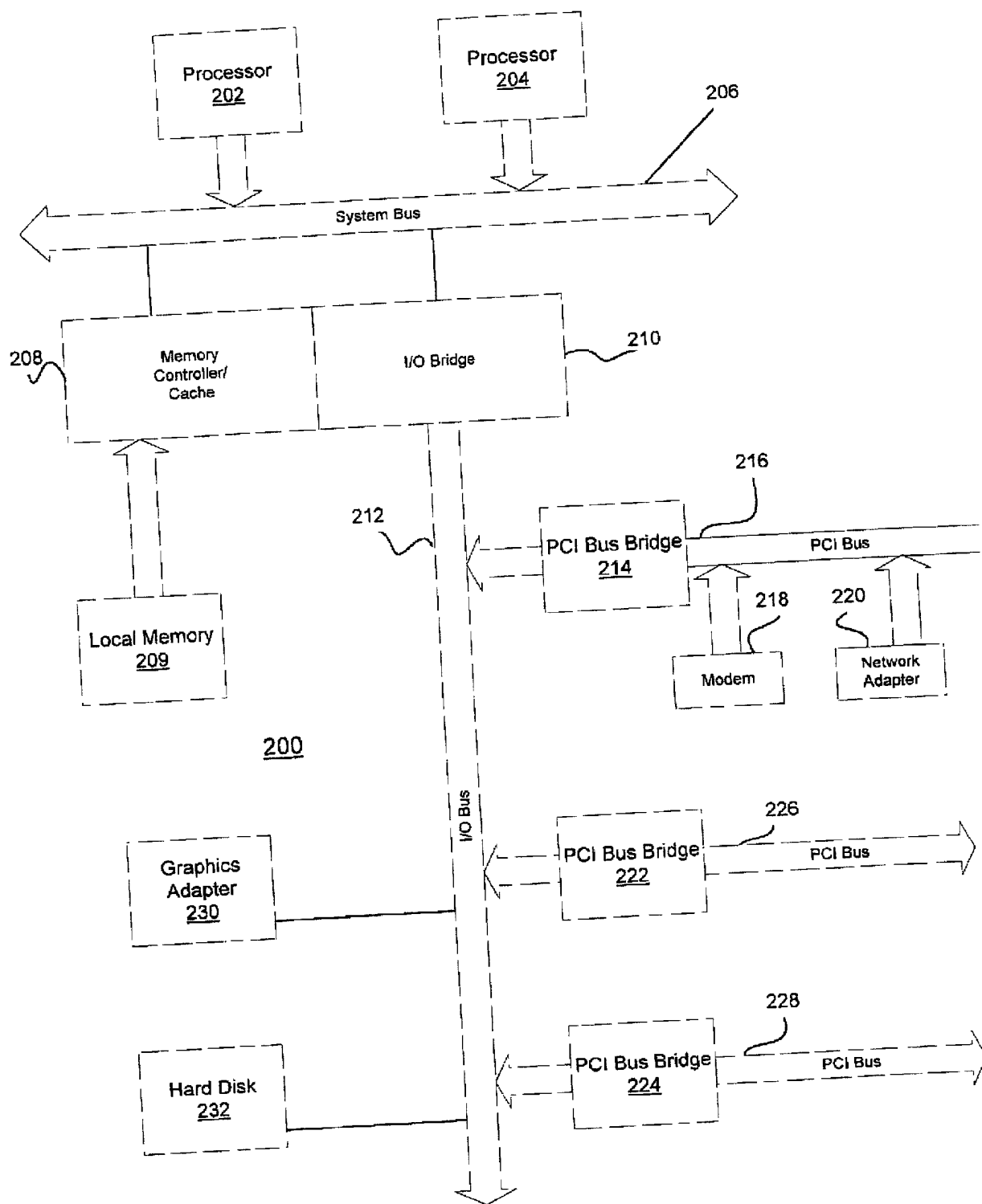
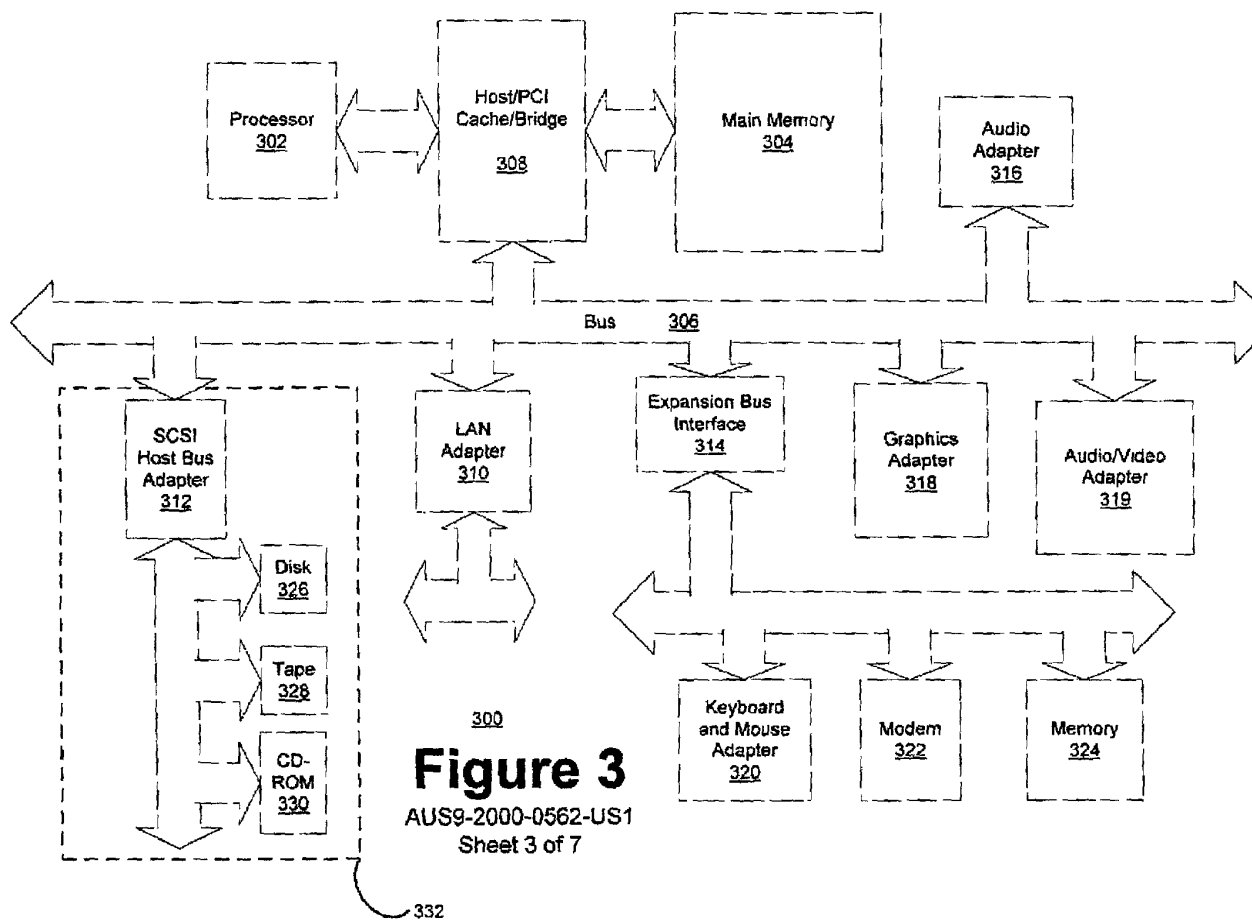


Figure 2

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Sheet 2 of 7

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400

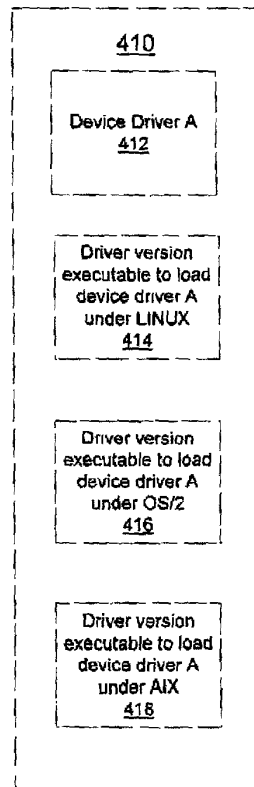
Figure 4A

AUS9-2000-0562-US1
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MACHINE A	LINUX	986986	402
MACHINE B	OS/2	924385	404
MACHINE C	AIX	286458	406

Figure 4B

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Sheet 4 of 7



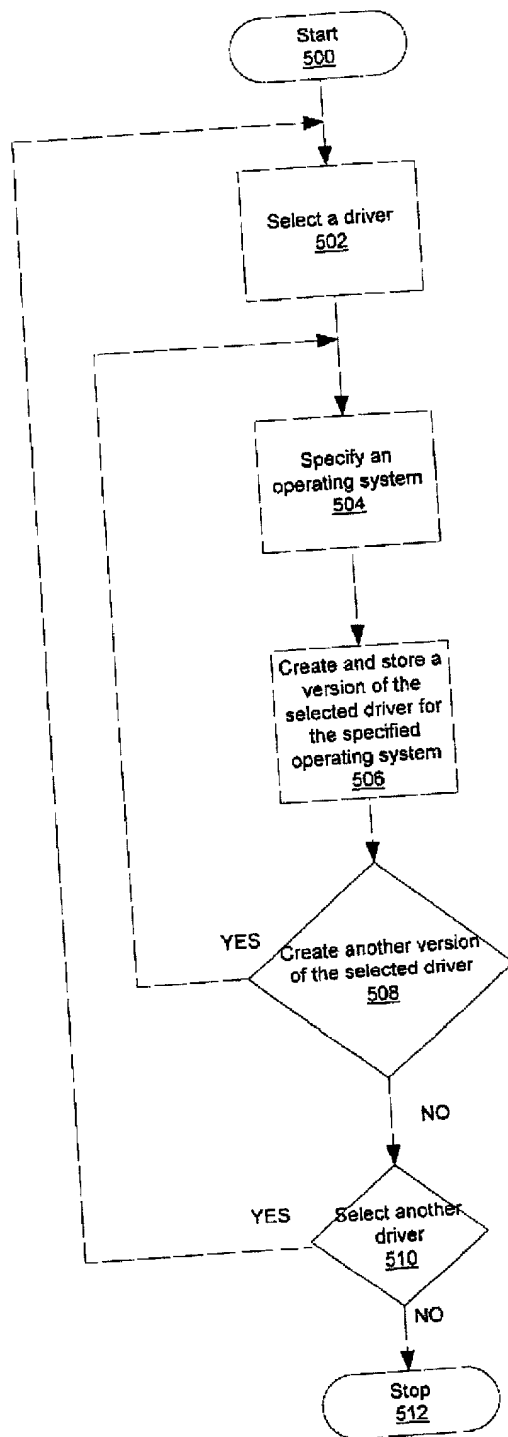


Figure 5
AUS9-2000-0562-US1
Sheet 5 of 7

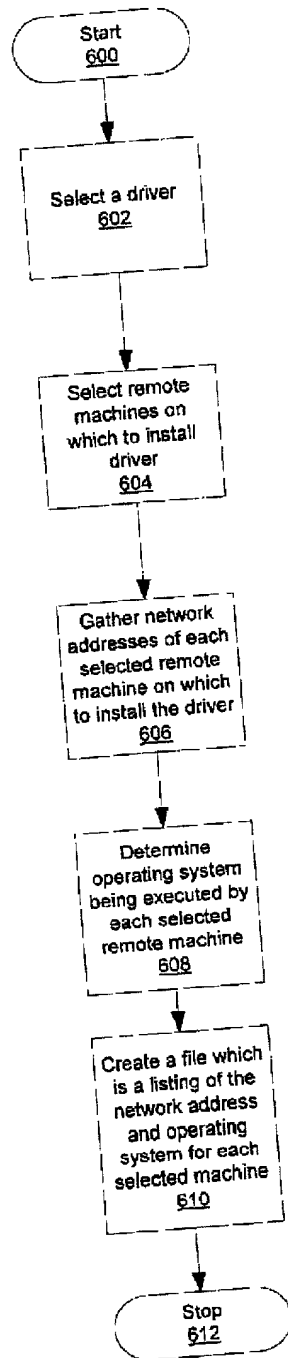


Figure 6
AUS9-2000-0562-US1
Sheet 6 of 7

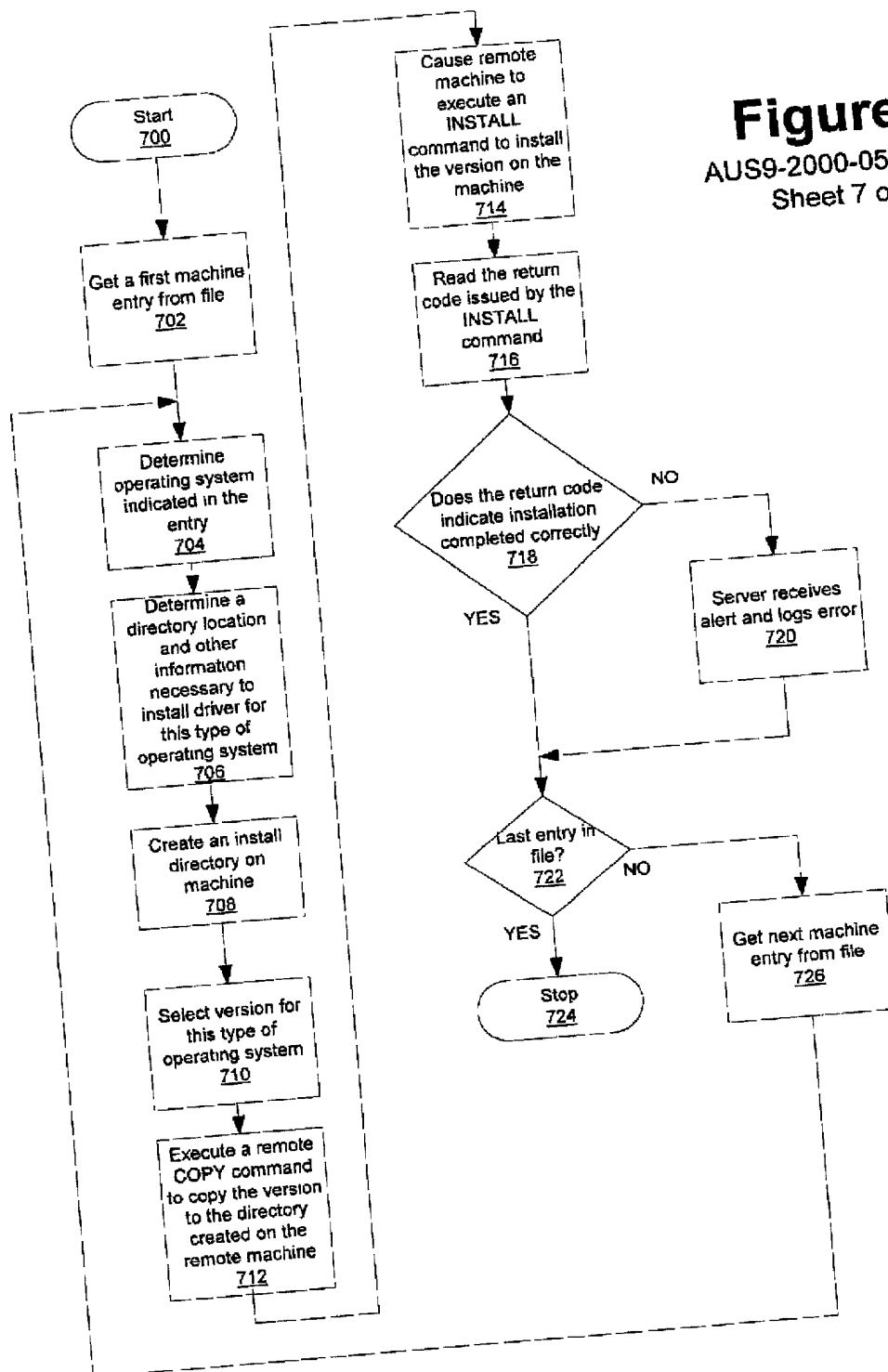


Figure 7
AUS9-2000-0562-US1
Sheet 7 of 7

**DECLARATION AND POWER OF ATTORNEY FOR
PATENT APPLICATION**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Data Processing System and Method for Distributing A Device Driver To A Plurality of Client Computer Systems Each Executing Different Operating Systems

the specification of which (check one)

X is attached hereto.

— was filed on _____
as Application Serial No. _____
and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s): Priority Claimed

_____ Yes___ No
(Number) (Country) (Day/Month/Year)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information material to the patentability of this application as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

_____ (Status)
(Application Serial #) (Filing Date)

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorneys and/or agents to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

John W. Henderson, Jr., Reg. No. 26,907; Thomas E. Tyson, Reg. No. 28,543; James H. Barksdale, Jr., Reg. No. 24,091; Casimer K. Salys, Reg. No. 28,900; Robert M. Carwell, Reg. No. 28,499; Douglas H. Lefevre, Reg. No. 26,193; Jeffrey S. LaBaw, Reg. No. 31,633; David A. Mims, Jr., Reg. 32,708; Volel Emile, Reg. No. 39,969; Anthony V. England, Reg. No. 35,129; Leslie A. Van Leeuwen, Reg. No. 42,196; Christopher A. Hughes, Reg. No. 26,914; Edward A. Pennington, Reg. No. 32,588; John E. Hoel, Reg. No. 26,279; Joseph C. Redmond, Jr., Reg. No. 18,753; Marilyn S. Dawkins, Reg. No. 31,140; Mark E. McBurney, Reg. No. 33,114; Duke W. Yee, Reg. No. 34,285; Colin P. Cahoon, Reg. No. 38,836; Stephen R. Loe, Reg. No. 43,757; Stephen J. Walder, Jr., Reg. No. 41,534; Charles D. Stepps, Jr., Reg. No. 45,880; Stephen R. Tkacs, Reg. No. 46,430, and Christopher P. O'Hagan, Reg. No. 46,966, Lisa L.B. Yociss, Reg. No. 36,975.

Send correspondence to: Duke W. Yee, Carstens, Yee & Cahoon, LLP, P.O. Box 802334, Dallas, Texas 75380 and direct all telephone calls to Duke W. Yee, (972) 367-2001

FULL NAME OF SOLE OR FIRST INVENTOR: Rick Allen Hamilton II

INVENTORS SIGNATURE: Rick Allen Hamilton II DATE: November 5, 2000

RESIDENCE: 1532 Dairy Road
Charlottesville, Virginia 22903

CITIZENSHIP: United States

POST OFFICE ADDRESS: SAME AS ABOVE

FULL NAME OF SECOND INVENTOR: Steven Jay Lipton

INVENTORS SIGNATURE: _____ DATE: _____

RESIDENCE: 2609 Maywood Court
Flower Mound, Texas 75028

CITIZENSHIP: United States

POST OFFICE ADDRESS: SAME AS ABOVE

Docket No. AUS9-2000-0562-US1

**DECLARATION AND POWER OF ATTORNEY FOR
PATENT APPLICATION**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Data Processing System and Method for Distributing A Device Driver To A Plurality of Client Computer Systems Each Executing Different Operating Systems

the specification of which (check one)

☒ is attached hereto.

☐ was filed on _____
as Application Serial No. _____
and was amended on _____
(if applicable)

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I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):	Priority Claimed					
<table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">(Number)</td> <td style="width: 30%;">(Country)</td> <td style="width: 30%;">(Day/Month/Year)</td> <td style="width: 10%; text-align: right;">Yes</td> <td style="width: 10%; text-align: right;">No</td> </tr> </table>	(Number)	(Country)	(Day/Month/Year)	Yes	No	
(Number)	(Country)	(Day/Month/Year)	Yes	No		

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information material to the patentability of this application as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

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Docket No. AUS9-2000-0562-US1

(Application Serial #)

(Filing Date)

(Status)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that those statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Send correspondence to: Duke W. Yee, Carlsons, Yee & Cahoon, LLP, P.O. Box 802334, Dallas, Texas 75380 and direct all telephone calls to Duke W. Yee, (972) 367-2001

FULL NAME OF SOLE OR FIRST INVENTOR: Rick Allen Hamilton II

INVENTORS SIGNATURE: _____ DATE: _____

RESIDENCE: 1532 Dairy Road
Charlottesville, Virginia 22903

CITIZENSHIP: United States

POST OFFICE ADDRESS: SAME AS ABOVE

FULL NAME OF SECOND INVENTOR: Steven Jay Lipton

INVENTORS SIGNATURE: Steven Jay Lipton DATE: 11/6/2000

RESIDENCE: 2609 Maywood Court
Flower Mound, Texas 75028

CITIZENSHIP: United States

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Docket No. AUS9-2000-0562 -US1

POST OFFICE ADDRESS: SAME AS ABOVE

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